DOE/GO-102001-1165
NREL/BK-710-29267
May 2001

7.4 Deconstruction

Deconstruction is a new term for an old process: building disassembly and material salvage. Deconstruction can range from "soft-stripping" of building components, such as mechanical equipment or hardwood flooring, to structural recovery of floor and wall assemblies. If the removal of a building can be planned and implemented carefully (as it was designed and built), deconstruction can greatly reduce landfill disposal as well as the resource use associated with the production of new building materials. EPA estimated in 1998 that 44,000 commercial buildings and 245,000 houses are demolished annually in the United States, accounting for 65 million tons (59 million tonnes) of material. If just half of those buildings were deconstructed, and only 10% of the materials salvaged from the ones being deconstructed, more than 3 million tons (2.7 million tonnes) of demolition waste could be kept out of landfills each year.

Opportunities

When a building reaches the end of its useful life, renovating the structure for reuse is always preferable to taking it down. If reuse is not possible, however, consider deconstruction rather than demolition, as there are lots of opportunities for waste reduction, reuse, and recycling of building materials and components. Deconstruction offers a double environmental benefit—when building materials or components are *salvaged for reuse*, landfill disposal is avoided and natural resources are conserved (by avoiding the production of new materials or components).

Deconstruction should be considered when one or more of the following conditions exist:

- Adaptive reuse of the building is not an option.
- The building is "designed for disassembly"—from precast-concrete double-T beams to pre-engineered metal buildings.
- The building contains high-value items such as "antique" brick, hardwood flooring, large-dimension structural timbers, modern mechanical equipment, and specialty masonry, woodwork, or metalwork.
- Adequate time exists to accommodate the lengthier process of disassembly.
- Local salvage markets exist or regional/national markets can be identified.
- Materials or components can be reused in-house, eliminating the need to identify markets.
- Salvaged components or materials can be specified by the A&E firm in the redevelopment taking place on the site where the building to be removed stands.
- The added labor costs of manual disassembly can be subsidized by a worker-training program.
- Local landfill tipping fees are high enough to push reuse as a cost-avoidance strategy.

Technical Information

Successful deconstruction requires careful planning. Recommended procedures or elements include:

Detailed building assessment: When a building slated for demolition is assessed for environmental hazards (lead-based paint, asbestos, PCBs, etc.), it can also be assessed for salvage potential. While full structural salvage might be appropriate only in very specific situations (see list above), less extensive levels of deconstruction should be considered for almost any building. (See the references for an example of a building materials inventory form.)

Contract language: The best mechanism for encouraging deconstruction is to specify materials recovery (reuse and recycling of building materials and components) in both the building-removal bidding and in the property-redevelopment process. Sources of model contract language are listed in the references.

Identification of used building material markets: A good way to support high rates of materials recovery is to provide potential bidders with as much market information as possible. For local resources, use the "Yellow Pages" and contact the local recycling office or coordinator. An increasingly useful regional and national resource is the Internet. A list of Internet-based used building material exchanges is listed in the references, and general Internet auction sites, such as www.freemarkets.com, should also be considered.

Training programs: Check with local construction trade

GENERATION OF DEMOLITION DEBRIS IN THE U.S.

Building Type	Demolitions per year	Average Bldg. Size sq. ft. (m^2)	Average Generation Rate lbs/sq. ft. (kg/m^2)	Total tons (tonnes)
Residential	245,000	1,396 (130)	115 (560)	19.7 (20) million
Nonresidential	43,795	13,300 (1,235)	155 (755)	45.1 (45.8) million
TOTAL	288,795	—	—	64.8 (65.8) million

Source: Tables 5 and 6, *Characterization of Building-Related Construction and Demolition Debris in the United States*, U.S. EPA, 1998.

unions or vocational schools on their needs for identifying and qualifying construction workers. An excellent way to both identify individuals with an aptitude for construction and familiarize them with how buildings are put together is to teach them how to take buildings apart. While incorporating a training program into the demolition schedule can be challenging, it can provide a labor subsidy that enables a level of disassembly far greater than might otherwise be possible.

Permit process: In some cases it is possible to compensate for the additional time that deconstruction usually requires by obtaining faster approvals for other aspects of the redevelopment process. Check with local regulatory authorities to find out if there is an opportunity for a *time benefit* to the contractor to offset the time penalty that deconstruction is likely to entail.

☑ The salvage and reuse of some building materials and components—older, non-1.6-gpf (6-liters-per-flush) toilets, single-glazed windows, and trim materials with lead-based paint, for example—need to be done with great care or not at all. For materials or components with poor resource efficiency or environmental and health risks, follow special procedures for *appropriate* reuse—for example, using salvaged windows for interior transom windows. Make sure that the reuse of vintage materials represents a real environmental gain.

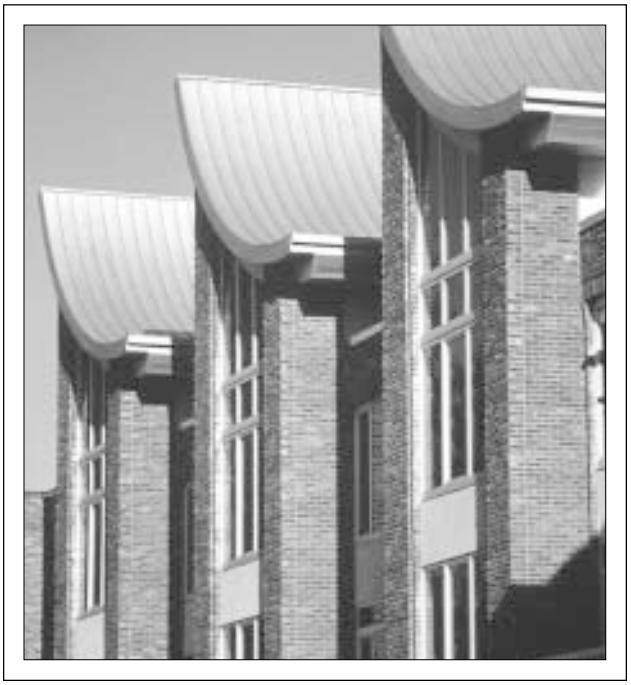
References

A Guide to Deconstruction: An overview of deconstruction with a focus on Community Development Opportunities, prepared by the NAHB Research Center for the U.S. Department of Housing and Urban Development, February 2000. Downloadable from the HUD Web site at www.hud.gov:80/deconstr.pdf.

Kincaid, Judith E., Cheryl Walker, and Greg Flynn, *WasteSpec: Model Specifications for Construction Waste Reduction, Reuse, and Recycling*, Triangle J Council of Governments, July 1995; www.tjcog.dst.nc.us.

Yost, Peter, "Deconstruction: Back to the Future for Buildings?" *Environmental Building News*, Vol. 9, No. 5, May 2000, BuildingGreen, Inc., Brattleboro, VT 05301; (800) 861-0954; www.BuildingGreen.com.

An example of a Building Materials Inventory Form may be found in Appendix B of "Deconstruction – Building Disassembly and Material Salvage: The Riverdale Case Study," NAHB Research Center, Upper Marlboro, MD, 1997; downloadable from the Web at either www.nahbrc.org or www.smartgrowth.org.



Source: Greater Vancouver Regional District

The C. K. Choi Building at the University of British Columbia features the extensive use of salvaged materials, including brick from a road in Yaletown, Vancouver.

See these resources for model contract language:

- UC–Santa Cruz Extension, Business Environmental Assistance Center, (800) 799-2322, and the Fort Ord Reuse Authority, (408) 883-3672.
- East Bay Conversion and Reinvestment Commission, (510) 834-6928.
- Defense Construction Canada, (613) 998-0468 (fax). The bid document includes an evaluation matrix for received bids.

Contacts

U.S. Environmental Protection Agency, Washington, DC; (202) 260-4048; www.epa.gov.

Department of Housing and Urban Development, Washington, DC; (202) 708-1112; www.hud.gov.

The Used Building Materials Association represents U.S. and Canadian building salvage firms and used building materials retailers; www.ubma.org.

The following sites are for used building material exchanges or retail operations:

www.greenguide.com
www.rbme.com
www.recycle.net/recycle/build/
www.renovators-resource.com
www.afandpa.org/Recycling/Wood/Search.htm
www.goodwood.org/goodwood/
www.woodexchange.com